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Abstract

A stamped and formed terminal post (11) having a compliant portion (16, 16') comprising first and second strip metal portions (12, 12' or 32, 32') fixed together at opposite ends to present planar rolled surfaces (13, 13') extending partially overlapping in face-to-face engagement. Remote edges (19, 19') of the respective strip portions (12, 12' or 32, 32') are laterally offset to engage the internal periphery of a through-hole (22) during insertion to effect sliding engagement of the surfaces (13, 13'). The compliant portion is formed by folding a strip through 180 degrees about a transverse axis to bring the overlapping portions of the rolled surfaces (13, 13') into engagement and securing the free ends together. In one example, the stock is split (33, 33') adjacent the fold to form two opposed, sheared edges (36, 37) that abut to resist movement together of the strip portion (12, 12') to increase the insertion force.

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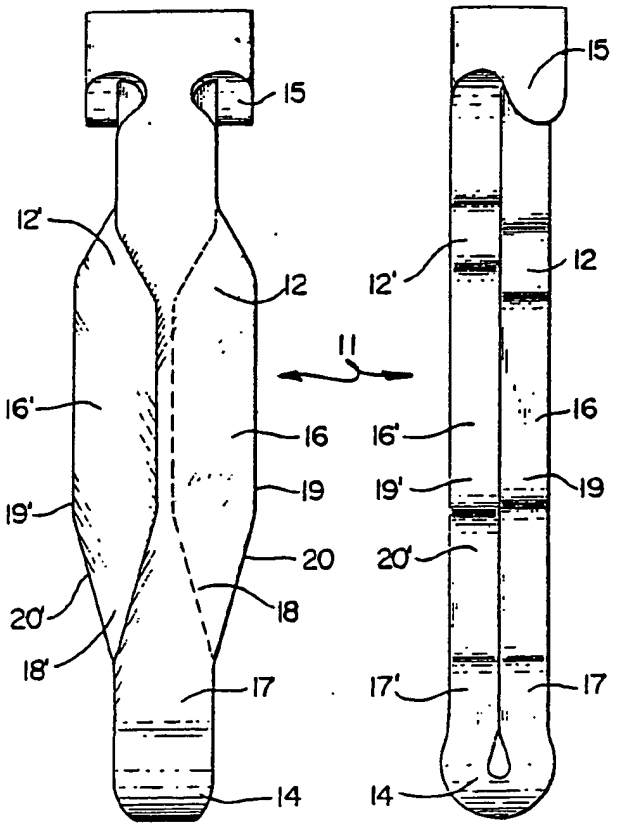
(54) Title: ELECTRICAL TERMINAL

(57) Abstract

A stamped and formed terminal post (11) having a compliant portion (16, 16') comprising first and second strip metal portions (12, 12' or 32, 32') fixed together at opposite ends to present planar rolled surfaces (13, 13') extending partially overlapping in face-to-face engagement. Remote edges (19, 19') of the respective strip portions (12, 12' or 32, 32') are laterally offset to engage the internal periphery of a through-hole (22) during insertion to effect sliding engagement of the surfaces (13, 13'). The compliant portion is formed by folding a strip through 180 degrees about a transverse axis to bring the overlapping portions of the rolled surfaces (13, 13') into engagement and securing the free ends together. In one example, the stock is split (33, 33') adjacent the fold to form two opposed, sheared edges (36, 37) that abut to resist movement together of the strip portion (12, 12') to increase the insertion force.



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ELECTRICAL TERMINAL

The invention relates to electrical terminals having posts with compliant anchoring portions for force fitting in through-holes in printed circuit boards to connect electrically the terminals to the conductive paths on the printed circuit boards.

The use of such terminals is becoming increasingly widespread as they provide a reliable electrical connection to a plated through-hole without a requirement for soldering and securely anchor the terminal in the printed circuit board.

An example of a widely used terminal of this type is described in U.S. Patent 4429459 and comprises a post, a portion of which is split longitudinally by shearing to form two limbs which are pushed out in opposite directions parallel to the plane of the shear with their sheared surfaces in partially overlapping condition so that during insertion into the through-hole, the limbs are resiliently forced towards each other with progressive sliding engagement of the sheared surfaces across each other in the plane of the shear further into overlapping engagement.

Terminals having compliant portions described above have a very high retention force which is desirable when, for example, connection is to be made to the post subsequently by a wire wrapping technique.

However, for many applications, the very high retention force for subsequent wire wrapping is not necessary and the associated disadvantages such as a high insertion force and the problem of distortion of the through-holes together with the manufacturing difficulties arising as a result of the close tolerances to be maintained should be avoided. In addition, the sheared surfaces may be undesirably rough and irregular providing an uneven frictional resistance.

According to one aspect of the invention, the limbs of the compliant portion comprise first and second metal strip portions fixed together at opposite ends to present planar rolled surfaces extending partially overlapping in face-to-face engagement, remote edge portions of the respective strip portions being engageable with the internal periphery of a through-hole during insertion therein to flex the strip portions further together with progressive sliding engagement of the rolled surfaces across each other further into overlapping engagement.

The resulting insertion forces are lower than with the prior version as the rolled surfaces have a lower coefficient of friction resisting movement of the limbs together during insertion than the sheared surfaces which are relatively rough. In addition, the limbs undergo essentially plastic deformation rather than the resilient deformation of the prior version maintaining the connection by a wedging action, both factors reducing substantially the risk of damage to through-holes. Furthermore, effective connection may be produced without any deformation of the through-hole.

The opposite ends of the strip portions may be fixed together by clinching or welding.

In a more specific construction, the limbs of the compliant portion are formed by bending a metal strip through 180 degrees about a transverse axis extending in its plane to bring the rolled surfaces of the strip portions into the partially overlapping relation and fixing the free ends of the strip portions together by clinching or welding thereby retaining the overlapping surfaces in mutual engagement.

The remote edges of respective strip portions may be coined to present a smooth radius to the through-holes, facilitating receipt therein.

The remote edge portions are located in mutually parallel relation, offset in laterally opposite directions from a longitudinal medial axis of the strip and extend laterally beyond overlapping portions of the limbs adjacent the fold, being joined thereby to divergent lead-in edges.

In order to control and limit the flexure together of the limbs and therefore the resistance to insertion, interengageable abutment surfaces are provided on the respective strip portions at locations, for example, on overlapping portions between the fold and the divergent lead-in edges.

The abutment surfaces may be formed by splitting the individual strip portions in aligned locations along a longitudinal, preferably medial, axis as by shearing, the stock portions on at least one side of the slit of one strip portion and on at least the opposite side of the slit of the other strip portion being pushed in opposite directions towards each other out of the planes of their respective strip portions to present a pair of opposed severed edges which will abut to resist movement together of medial portions of the strip portions.

Preferably, both of the stock portions on respective sides of the resulting slits are pushed out of the planes of the respective strip portions in respective opposite directions so that a sheared edge of one strip portion on one side of the slit is located opposite the sheared edge on the other side of the slit in the other strip portion, the pushed-out portion of the one strip portion protruding into an aligned recess in the other strip portion defined by the respective pushed-out portion.

The invention includes the electrical connection formed between the compliant portion and a plated through-hole of a printed circuit board.

Examples of other terminals having compliant portions which are relatively difficult to manufacture are illustrated in U.S. 4324451 and U.S. 4066326. EP 45153 discloses a terminal in which interengageable camming portions are provided on opposed folds of a pair of legs for insertion into an aperture in a printed circuit board, while Japanese U.M. 58-14683 discloses a terminal with another different compliant portion.

An example of an electrical terminal including a compliant portion according to the invention will now be described with reference to the accompanying drawings in which:

Figure 1 is a front elevation of the compliant portion;

Figure 2 is a side elevation;

Figure 3 is a cross-sectional view prior to insertion in a through-hole;

Figure 4 is a similar view after insertion in a plated through-hole;

Figure 5 is a view of a strip of blanks from which the compliant portions are formed;

Figure 6 is a perspective view of a second example of the compliant portion; and

Figure 7 is a transverse cross-sectional view of the second example.

The electrical terminal 11 comprises first and second limbs constituted by strip portions 12 and 12', respectively, with respective rolled surfaces 13 and 13', and joined together in face-to-face engagement at respective opposite ends by an integral fold 14 and a pair of ears 15 extending laterally from each edge of one strip portion 12 and clinched along opposite edges of the other strip portion 12'. Medial parts 16,16' of respective strips 12,12' are offset in opposite directions in the planes of the strips from the longitudinal medial axis so

that their remote edge portions 19,19' respective extend in mutual parallel relation, and laterally beyond, parts 17,17' of the strip portions adjacent the fold 14 to which they are joined by mutually divergent strip parts 18,18', respective providing remote lead-in edges 20,20', respectively. This results in the rolled surfaces of the medial parts partially overlapping and in engagement.

The terminals are formed from a strip of blanks shown in Figure 5, but it will be understood that various (different) contact elements may also be incorporated adjacent the carrier 21 according to desired application.

During insertion, fold first, into a plated through-hole 22 in a printed circuit board, engagement of the remote edge portions 20,20' of the respective strip portions with the edge of the through-hole urges the strip portions further into overlapping engagement by progressive sliding movement of the rolled surfaces 13,13' across each other. This provides a desirable controlled dynamic frictional characteristic providing an insertion force which progressively increases as the area of contact increases. The strip portions undergo progressive plastic deformation during insertion so that the residual spring force on the through-hole is relatively small, but progressive collapse and the resulting wedging action produces and maintains intimate engagement of the rolled edges 19,19' with the through-hole ensuring a reliable electrical connection without distortion of the through-hole.

As the terminals can be produced from thin metal stock by a simple stamping and forming technique without the high degree of precision required for accurately shearing a metal post, the terminals are economic to manufacture and, in view of their lower insertion force, economic to assemble with the circuit board.

In a second example, shown in Figures 6 and 7, the strip blank is formed with creases 30 or waisted at locations adjacent but spaced from the fold, hardening the material to enable the blank to be folded about a predetermined radius to bring the surfaces of the folded portions into engagement without cracking at the fold. Abutment surfaces 36,37' for controlling the flexure together, and therefore the insertion force, of the strip portions 32,32' are provided by splitting the individual strip portions in aligned locations along a longitudinal, medial, axis as by shearing, and the stock portions 34,35', 34'35 on both of the respective sides of the resulting slits 33,33' are pushed out of the planes of the respective strip portions 32,32' in respective opposite directions so that a sheared edge 36 of one strip portion 32 on one side of the slit 33 is located opposite the sheared edge 37' on the other side of the slit 33' in the other strip portion 32', the pushed-out portion 34 of one strip portion protruding into an aligned recess 38' in the other strip portion 32' defined by the respective pushed-out portion 34'.

CLAIMS:

1. An electrical terminal (11) including a metal post for receipt in an aperture (22) in a printed circuit board and having a compliant portion comprising first and second limbs (12,12') fixed together at respective opposite ends having opposed surfaces (13,13') extending partially overlapping in face-to-face engagement, remote edges (19,19') of the respective limbs (12,12') being engageable with the internal periphery of the aperture (22) during insertion therein to flex the limbs (12,12') further together with progressive sliding engagement of the opposed surfaces (13,13') across each other further into overlapping engagement, characterised in that:

the limbs (12,12') are constituted by strip portions (12,12') with planar rolled opposed surfaces (13,13').

2. A terminal according to claim 1, characterised in that the limbs (12,12'; 32,32') of the compliant portion are formed by bending a metal strip through 180 degrees about a transverse axis extending in its plane to bring the rolled surfaces (13,13') of the strip portions (12,12'; 32,32') into the partially overlapping relation and fixing the free ends of the strip portions (12,12'; 32,32') together.

3. A terminal according to claim 1 or claim 2, characterised in that end of the strip portions (12,12') are fixed together by clinching.

4. A terminal according to claim 1 or claim 2, characterised in that ends of the strip portions (12,12') are fixed together by welding.

5. A terminal according to any one of the preceding claims, characterised in that the remote edge portions (19,19') are located in mutually parallel relation offset in laterally opposite directions from a longitudinal medial axis of the strip and extend laterally beyond overlapping portions of the limbs (12,12'; 32,32')

adjacent the fold (14), being joined thereto by divergent lead-in edges (20).

6. A terminal according to any one of the preceding claims, characterised in that abutment surfaces (36,37') are provided on the respective strip portions (12,12'; 32,32') on overlapping portions between the fold (14) and the divergent lead-in edges (20), which surfaces are interengageable to limit the flexure together of the limbs (12,12'; 32,32').

7. A terminal according to claim 6, characterised in that the abutment surfaces (36,37') are formed by splitting the individual strip portions (32,32') in aligned locations along a longitudinal axis, stock portions (34,34') on at least one side of the slit (33) of one strip portion (32) and on at least the opposite side of the slit (33') of the other strip portion (32') being pushed in opposite directions towards each other out of the planes of their respective strip portions (32,32') to present a pair of opposed severed edges (36,37') which will abut to resist movement together of medial portions of the strip portions (32,32').

8. A terminal according to claim 7, characterised in that both of the stock portions (34,35'; 34',35) on respective sides of the resulting slits (33,33') are pushed out of the planes of the respective strip portions (32,32') in respective opposite directions so that a sheared edge (36) of one strip portion (32) on one side of the slit (33) located opposite the sheared edge (37') on the other side of the slit (33') in the other strip portion (32'), the pushed-out portion (34) of one strip portion (32) protruding into an aligned recess (38') in the other strip portion (32') defined by the respective pushed-out portion (34').

9. An electrical terminal (11) stamped and formed from sheet metal stock, comprising first and second limbs

constituted by strip portions (12 and 12′ or 32 and 32′), respectively, with respective flat surfaces (13 and 13′), and joined together in face-to-face engagement at respective opposite ends by an integral fold (14) and a clinched portion (15) respectively, medial parts (16,16′) of respective strips (12,12′ or 32,32′) being offset in opposite directions in the planes of the strips from the longitudinal medial axis so that their remote edge portions (19,19′) respectively extend laterally beyond parts (17,17′) of the strip portions adjacent the fold (14) to which they are joined by mutually divergent strip parts (18,18′), respectively providing remote lead-in edges (20,20′), respectively.

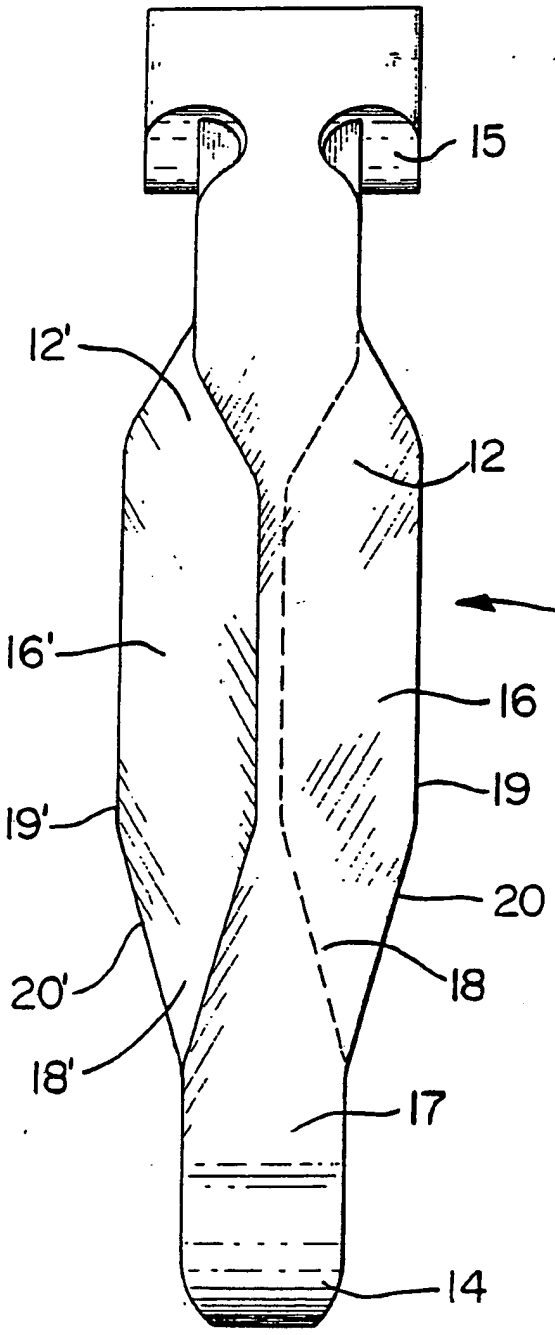
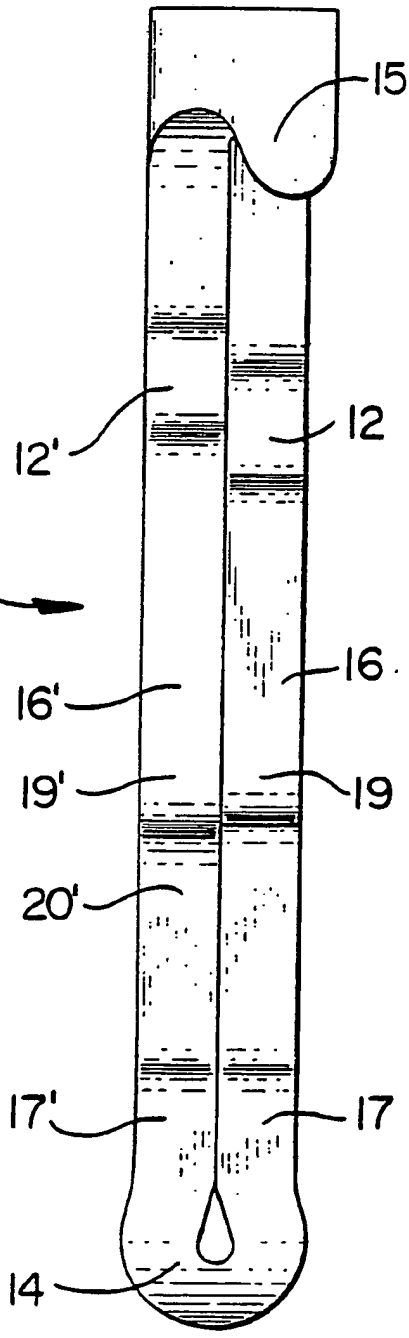

15
12'
12
16'
16
19
19'
20
20'
18
18'
17
14

FIG. 1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12'
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16'
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19'
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20'
17'
17
14

FIG. 2

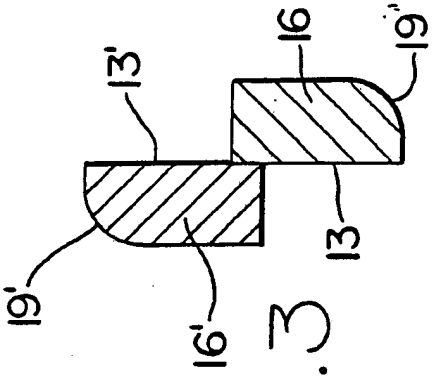

FIG. 3

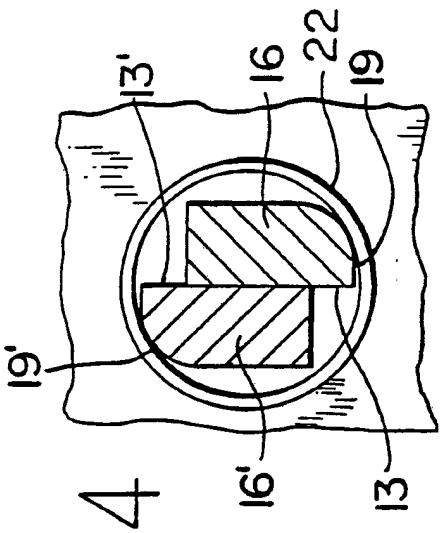

FIG. 4

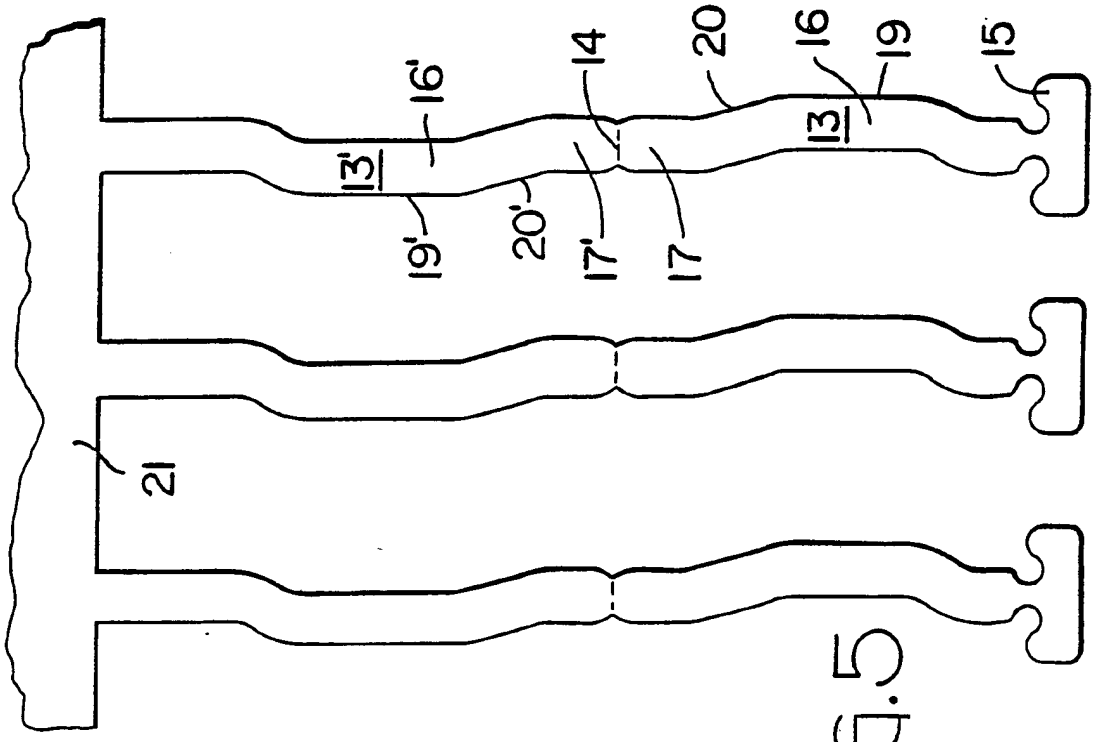

FIG. 5

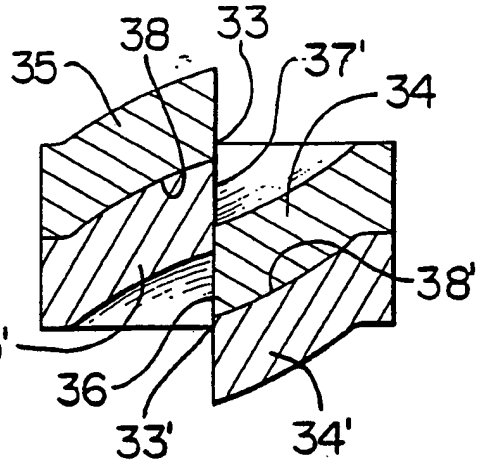

FIG. 7

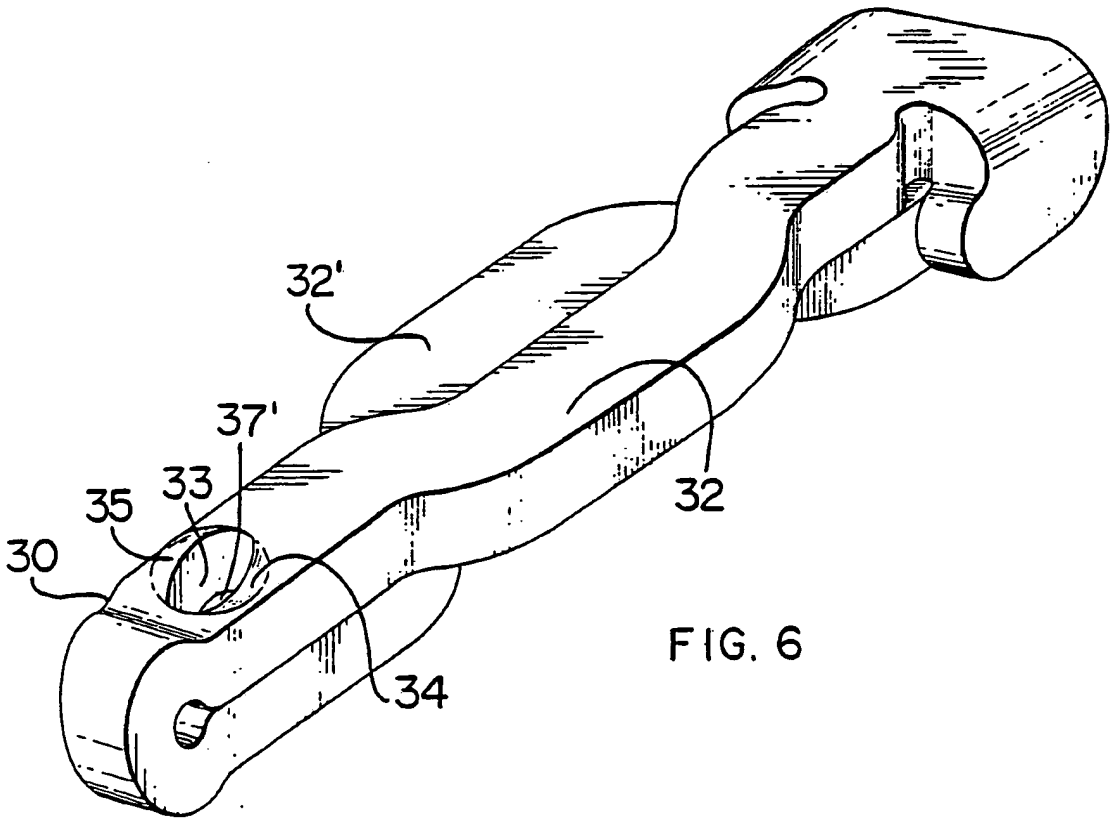

FIG. 6

INTERNATIONAL SEARCH REPORT

International Application No PCT/US 87/01810

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC[4]: H 01 R 9/09

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC[4]	H 01 R 9/00 H 01 R 13/00 H 01 R 23/00

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
Y	FR, A, 2287827 (DU PONT) 7 May 1976 see page 6, lines 23-27; figures 1-8	1,2,5
Y	US, A 4324451 (ELFAB) 13 April 1982 see column 6, lines 30-49; figure 2	1,2,5
A	EP, A, 0134094 (AMP) 13 March 1985 see page 3, lines 7-33; figures 1,2	1,6-9

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* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
30th October 1987	1 DEC 1987
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	M. VAN MOL

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON

INTERNATIONAL APPLICATION NO. PCT/US 87/01810 (SA 18157)

This Annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 06/11/87

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Patent document cited in search report	Publication date	Patent family member(s)		Publication date
FR-A- 2287827	07/05/76	NL-A-	7511863	13/04/76
		DE-A-	2545505	22/04/76
		US-A-	4066326	03/01/78
		GB-A-	1502864	08/03/78
		JP-A-	51063460	01/06/76
US-A- 4324451	13/04/82	US-A-	4418475	06/12/83
EP-A- 0134094	13/03/85	JP-A-	60062071	10/04/85
		US-A-	4655537	07/04/87